UTILIZING INFORMATIONAL TEXTS IN TEACHING ELEMENTARY SCIENCE

Esra Ibil

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Esra Ibil

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Master's Thesis Committee

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Meredith Park Rogers, PhD.

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David Flinders, PhD.

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Karen Wohlwend, PhD.

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Introduction

Informational texts can be efficient resources for stimulating curiosity and interest in science and contributing to the development of positive scientific attitudes. When students read, they participate in essential scientific and literacy processes, for instance, predicting, generating questions, summarizing understandings, and using data to draw conclusions (Yopp & Yopp, 2006). The 2010 Common Core State Standards emphasized the importance of informational text use in primary education. The Standards also set out a vision of what it means to be a literate person in the 21st century as a natural outcome of preparing for college and career readiness. Through reading texts in history, social studies, science, and other disciplines, students develop a theoretical base in these fields, which also gives them a framework for critical reading in all content areas. This foundation is acquired by students when the curriculum is intentionally and coherently designed to establish a rich knowledge of content. Also, informational reading helps students achieve the habit of reading independently, which is important to their future success (CCSS, 2010). Prior to the Common Core State Standards emphasis on the use of informational texts, Duke (2000) found that children in first grade classrooms spent only 3.6 minutes per day engaged in written language activities with informational texts. Moss (2005) argued that at the primary level a minimum of one third of reading instruction time should be spent on informational texts and at the upper elementary level the amount of time spent reading such texts should rise to around 40% in the fourth grade, 50% in the fifth grade and 60%–65% in the sixth grade.

The integration of literacy and science subjects by incorporating language modeling and concept development facilitates students' understanding of scientific concepts and their language

development (LaParo, Pianta & Hamre, 2008). Scientific concepts require understanding of complex vocabulary. Helping children broaden their vocabulary is one of the best ways to encourage them to be active learners of science by increasing their science literacy (Tabors, Snow, & Dickinson 2001). For instance, children can practice using scientific vocabulary to record their observations in inquiry activities (LaParo, Pianta & Hamre, 2008). Furthermore, integrating reading and content instruction in all elementary grades can help children acquire reading to learn while they are learning to read. At the primary level, reading instruction can help students learn to read in parallel. Such interactions with non-fiction, informational texts can prevent the decline in achievement that often occurs in the intermediate grades when students must meet reading requirements in order to learn (Moss, 2005).

By reading nonfiction texts, often referred to as trade books because they are not written specifically for use in schools, students at various levels of proficiency can gain in-depth, knowledge on particular topics. Pike and Mumper (2004) pointed out that nonfiction texts can also provide realistic literacy experiences and help students develop skills they will use throughout their lives. Among its benefits, they claim that reading nonfiction

- Builds background knowledge and develops concepts
- Enhances vocabulary development
- Familiarities students with the writing style of expository texts
- Provides models for writing succinctly
- Facilitates purposeful, authentic learning
- Promotes inquiry, discovery, and active learning

- Enhances visual literacy
- Utilizes visuals to clarify information
- Promotes student self-confidence and self-esteem since students can become knowledgeable about a topic
- Satisfies and increases curiosity
- Gives options to students who enjoy and prefer non-fiction
- Whets students' appetites for obtaining information, which can lead to further reading of additional informational texts (p.10).

Informational texts are more effective than traditional textbooks for meeting the needs of students with diverse backgrounds, interests, needs, and levels of reading. These books also include contextualized, focused, in-depth, and up-to-date content (Fang, 2013). Duke (2003) similarly observed that reading informational texts supports students' continued development as readers who will encounter compelling texts through schooling and in their lives. If the students learn how to read and learn from informational texts in early grades, they are likely to develop effective reading habits and skills for learning from informational texts (Duke, 2003).

Learning how to read informational texts is crucial for students to science content and the epistemology of science, as science is constituted by texts and scientific knowledge conveyed primarily through reading these texts. On the other hand, failure to learn how to read informational scientific text can leads to superficial understanding of science, regardless of how much science material is consumed (Norris & Phillips, 2003). To prepare children for a world in which understanding science is increasing critical, informational texts need to be integrated in

the curriculum. Furthermore, the more informational texts are included, the more improve children's reading development is supported, especially for children who develop a preference for reading informational texts. By presenting thought-provoking and meaningful topics, such texts address children's questions and interests while building their knowledge of the natural and social worlds around them. Lastly, informational texts provide a variety of text features such as vocabulary and graphics which support children's literacy development (Duke, 2003).

Purpose

The purpose of the present study is to review previous literature on informational text use in elementary science education in order to suggest best practices as a resource for teachers and curriculum designers. This discussion begins with definitions of informational texts and explanation of their vital role in students' present learning and preparation for lifelong learning. The methodology of the study is then described, followed by a critical review of relevant research and suggestions for how elementary education teachers might integrate these texts into science instruction. Implications for future research will also be suggested.

Definitions

The two main categories of literature are poetry and prose. Prose can be classified into fiction and nonfiction, and these categories can be further subdivided by genre. Nonfiction texts usually focus on a particular topic and provide verifiable information and evidence-based ideas. As a complex genre, nonfiction presents concepts, reasoned arguments and interpretations, and values, and may be delivered in oral or visual formats based on main ideas and uses both oral and visual texts. In science education informational texts usually contain factual knowledge, ideas, and principles related to the physical, biological, or social world. At the elementary level, the emphasis is on informational texts that provide factual knowledge. At all levels, informational texts are used to inform, instruct, and enlighten (Fountass & Pinnell, 2001).

In the process of conducting this literature review, it was found that scholars use many terms interchangeably to refer informational texts, such as science texts, informational texts, informational books, trade books, nonfiction texts, and nonfiction books. Maloch and Bomer (2013) declared that teachers and researchers should understand the different ways in which the term "informational text" is defined and used. They also stated that nonfiction and informational text are broad categories that vary from one another in purpose, structure and mode. Saul and Dieckman (2005) defined elementary informational texts as children's books which convey information about the real world to readers. Duke and Tower (2004) pointed out that nonfiction consists of many genres, which include informational texts, concept books, biographies, procedural texts and reference materials.

Dowd (1992) emphasizes that informational texts can have many different features, for example, three-dimensional formats such as movable books with pop-ups, pages with pull-tabs and lift-flaps, and full-color visuals on vinyl pages. Topics can pertain to scientific, technological, physical, or social subjects. Different types of informational texts allow students to understand that there are various ways to present and access information. Through text-based science teaching, students can learn how to access information in a variety of texts, which can be a rewarding experience and a necessary aspect of scientific education (Howes, Lim, & Campos, 2009). These texts can also provide realistic literacy opportunities, which help students develop skills they will use throughout their lives such as analyzing and synthesizing information from various sources as they construct knowledge. Therefore, informational texts must be reliable and up-to-date (Pike & Mumper, 2004). Also, as Harvey (1998) pointed, nonfiction includes various media such as magazines and newspapers as well as books, all of which can captivate students' attention and allow them to connect to their daily life experiences.

Method

Narrative literature review was the method used in this research. Narrative literature reviews analyze relevant past researches and synthesize them into a coherent discussion. Compared to other types of literature reviews, narrative reviews are broadly focused, discussing methodologies, findings, and limitations in the current state of knowledge about a particular topic or area (Feak & Swales, 2015). A literature reviews is a form of documentary research focused on academic written texts. Typically it includes key publications by past and present scholars related to a focal area or topic, often supported by other articles to demonstrate the range and variety of research locations, interests and findings (Tight, 2019).

For this literature review searches were conducted on EBSCO, ERIC, ProQuest Dissertation and Theses Global, JSTOR, SCOPUS, IUCAT, Web of Science, Children's Core Collection and Google Scholar. The search was performed using several terms including science education, literacy and science, informational texts, nonfiction books, nonfiction trade books, informational books, elementary science, children's literature and science education, teaching science in elementary education.

Teachers' Role

By integrating this kind of literature, teachers can incorporate different contexts, ideas, and cultures that can facilitate discussion of science subjects. Reading trade books may help students not only relate to their environment but also develop an understanding of reading as something other than a school task (Mahzoon, Yebra, Johnson, & Sohn, 2018). The variety of interactive formats appeals to children's need to learn by doing and manipulating. Also, informational texts can simplify advanced topics for young audiences, which is particularly important in science. Informational texts specifically for children provide ample spaces for illustrations and graphics that help convey complex information. Furthermore, informational

texts are representative of scientific documentation and research. Thus, children can understand that science writers need to do research for facts. Another advantage is that children's informational texts generally focus on a particular aspect of a subject in an interesting style rather than presenting lengthy and less engaging coverage of several aspects. For instance, trade books may provide factual information in a humorous way. As children learn through interactions between the left- and right-brain hemispheres, or through both logic and creative experiences, this combination of humor and fact is enjoyable, educational, and appropriate for young learners (Dowd, 1992).

While teaching science in the elementary classroom, teachers should consider children's reading interests and levels. The assigned textbook is not the only source of knowledge. Because each child has different reading interests, and teachers can supplement the textbook and enrich the learning environment by bringing in picture books, magazines, newspapers, blogs, and other online sources. Such interesting and information-rich texts on relevant subjects will introduce students to new language and text structures while supporting interaction with content learning (Webster, 2009). Also, the children can have access to resources based on their interests As Duke (2009) notes, some children prefer informational texts, referred to as "info kids" by educators Jobe and Mary Dayton-Sakari (2002). Whatever children's interests and preferences, having a wide choice of materials will likely motivate them to continue reading and improve their reading ability (Duke, 2003). Thus, the students have the benefits of both having different types of sources and learning to use multiple sources.

Teachers can create productive inquiry-based science instruction by incorporating informational books. According to Mantzicopoulos and Patrick (2011), high quality information science books enable children to develop practices that are consistent with scientific practices,

for example, to ask questions about the natural world, to predict and investigate, and to document and report findings and conclusions. To effectively integrate informational texts into science education teachers should develop lessons in which an investigation is first conducted and used to generate questions that can be addressed through the use of informational texts (Vick, 2016). Simply reading informational science texts without the context of their own inquiry, children may not build a solid understanding of science concepts. Gaining a deeper understanding of concepts requires additional support and guidance. By engaging in a variety of experiences that activate scientific thinking, students can learn conceptually and apply their new knowledge to other situations (Stewart & Chesley, 2014).

Teachers also need to model various ways of presenting information, such as visually through charts or graph or using sticky notes as organizational tools (Miller, 2013). They also should provide a continuum into deep reading to systematically activate readers' comprehension and knowledge construction. The notion of a continuum of comprehension, developed by Harvey and Daniels (2015), consists of five levels: answering literal questions, retelling, merging thinking with content, acquiring knowledge, and using knowledge actively. This process encourages students to connect content to their own background knowledge, challenge their thinking, and come up with ways to apply their new knowledge (Vick, 2016).

A Framework for K-12 Science Education (NRC, 2012) states that just as scientists need to communicate their findings clearly and persuasively for science to progress, students gain valuable scientific skills by engaging in research writing, and communicating about science topics. Incorporating informational texts into the 5E model (Engage, Explore, Explain, Elaborate and Evaluate) enables students to obtain, evaluate, and communicate information from multiple sources as scientists do (Royce, 2015). For example, Royce (2015) used 5E science teaching

methods with second grade students by giving them a book about the history of toys and asking them to compare past toys to current toys. In the Engage phase of the 5E model, the students engaged with the book by bringing in their own toys, and in the Explore phase they discussed past and current toys. During the Explanation phase, the students explained the toys' properties in detail and created scientific notes including the details. In the Elaboration phase, the students incorporated the features of past and current toys to create new future toys. In the final Evaluate phase, their products were assessed. This study provided an example of how informational texts can be integrated into elementary science teaching in classrooms to foster students' ability to read, write, and communicate knowledge as scientists (Royce, 2015).

Contexts

Literacy approaches will promote children's critical thinking and reasoning skills, and allow them to develop a deeper understanding of the nature scientific theories and the science around them. Additionally, these approaches enable children to think critically by engaging them in the planning, assessment, discovery and conclusion of investigations (Liston & Hennessy, 2016). Children's science and literacy learning can benefit from engagement with texts and connections with their background knowledge and experiences to examine, wonder about, and question the claims, events, or ideas presented in texts (Cervetti, Pearson, Bravo & Barber, 2006), which help them develop critical thinking skills. When students get engaged in expository texts such as nonfiction trade and picture books, narrative texts, and other informational texts, they benefit from exposure to scientific language and the methods of inquiry that are modeled in the books (Pappas & Varelas,. 2009).

Norris and Phillips (2003) stated that the nature and structure of science are strongly related to reading and writing, which are essential to the learning of science. Omitting reading

and writing from scientific learning destroys proper science as much as if observation, measurement or experimentation were removed. Additional approaches to hands-on science activities, including conversation, preparation, reading and writing, further discussion and argument, are needed (Webb, 2010). Reading and writing are storage and transmission tools which are constitutive parts of science. In classrooms that highlight inquiry, basic literacy activities such as reading, writing, and oral discourse are important for gaining an understanding of the core ideas of science (Krajcik & Sutherland, 2010). Scientific literacy means having the necessary knowledge and understanding of scientific concepts and processes to make supportable decisions with regard to civil and cultural affairs and economic productivity (National Research Council, 1996). Indeed, literacy in the fundamental sense resembles scientific thinking and reasoning, which are required to comprehend, interpret, analyze, and criticize information and ideas (Norris & Phillip, 2003).

Informational texts are generally related to textbooks, nonfiction materials such as science-based informational texts and trade books can be used to complement or substitute for textbooks in science teaching. Fang (2013) states that trade books can introduce students to a wide range of reading texts in disciplinary learning. Nonfiction books offer young children new life experiences, new vocabularies, and new literacy environments tin which to be entertained and to experience perspectives other than their own (Mendoza & Reese, 2001). Additionally, the variety of informational texts can provide involvement in experiments which cannot be conducted in a classroom, giving students the benefit of vicarious experiences. Informational texts may address subjects that are not directly accessible to most students (e.g. volcanoes, earthquakes) or that occur over long periods of time (e.g. weathering, evolution, geological time) (Vick, 2016). For example, young children are unable to develop a real understanding of the

interdependence of living entities through their daily life experiences. It is impossible for children to actually observe the variety of species or to explore ecosystems within a classroom. Nonfiction picture books can be effective teaching tools to extend the range of their experiences (Stewart & Chesley, 2014).

Science-based informational texts are also good tools for providing scientific facts, concepts and clarifications. As Fountass and Pinnell (2001) indicate, informational texts cover all research areas that may be of interest to readers, such as cooking, animals, sports, religion, geology, technology, space, and the history of these and other topics. Also, timely informational texts provide updated and accessibly written information by qualified experts. In addition, the content and organization of science texts are likely to add new concepts or relationships to readers' knowledge. An ideally designed science text makes clear connections between the content and readers' background knowledge. thus, activating their involvement, making it one of the most powerful tools available for teaching science, increasing reading comprehension of scientific topics, and correcting misconceptions. By making such connections within the text and to previously learned information clear, science-based texts promote learning (Van den Broek, 2010).

Instructional Strategies

Science texts are introduced for a variety of purposes such as increasing students' knowledge of science; writing science-based essays or arguments; improving oral discourse in science, both explanations and arguments; improving mastery of science and supporting students' engagement in scientific inquiry vocabulary (Cervetti & Pearson, 2018). The National Research Council (2000) defined scientific inquiry as the ways in which scientists study the natural world and derive explanation based on the evidence of their observations.. Inquiry is a

multi-faceted activity involving observations; asking questions; analyzing books and other information sources to see what is already known; conducting investigations; evaluating what is already known in the light of experimental evidence; using methods to capture, evaluate and interpret data; providing responses, theories and predictions; and communicating the findings (NRC, 1996). As an activity for students, inquiry entails developing knowledge and understanding of scientific ideas as well as of how scientists study the natural world. Similarly, reading as inquiry involves inferring meaning from text and interpreting it by integrating relevant text information with relevant prior knowledge. Interpretation involves exploring meanings that are presupposed, implied, and reasonably justified by the text. Prior knowledge is made relevant to an interpretation by forging inferential links between the knowledge and the text, highlighting reading as a constructive process. Having prior knowledge about a topic is useless to a reader who does not see its relevance and make appropriate inferential links (Philips & Norris, 2009).

Krajcik and Sutherland (2010) proposed five instructional features of literacy that are important to embed in inquiry science, which are linking new ideas to prior knowledge and experiences, anchoring learning in questions that are meaningful in the lives of students, connecting multiple representations, providing opportunities for students to use science ideas, and supporting students' engagement with the discourses of science. These five features will promote students' ability to read, write, and communicate about science so that they can engage in inquiry throughout their lives. The first feature, activating prior knowledge and connecting new knowledge to existing knowledge, is key to constructing understanding. The second emphasizes the importance of attending to students' questions that arise from their life experiences, thus motivating them to explore phenomena by reading science texts and writing about science topics and participating in scientific research. The third important element in the

growth of literacy in science is the ability to understand multiple representations such as models, maps, diagrams, simulations and graphs. The fourth feature, providing students with opportunities to use science ideas, entails giving them new situations and problems with which they can express, interpret, criticize, apply and expand their evolving understandings of science. The fifth practice for fostering student's inquiry and literacy skills is to involve them in constructing explanations and arguments, which are essential components of scientific discourse. Students need to have opportunities to talk and write about science experiences with evidence to support their ideas. Writing has many roles in research, including the documentation and organization of data and composing reasoned arguments for why evidence supports one claim more than another (Krajcik & Sutherland, 2010).

Scientific literacy instruction, should involve students in making sense of scientific texts as a form of scientific inquiry. Inquiry guided literacy activity is not a passive processing of science knowledge but an active interpretation process, which is in itself an important kind of science work (Pearson, Moje & Greenleaf, 2010). Inquiry units provide students with opportunities for comprehensive immersion in topics of interest in a variety of content-related materials. By focusing on students' own questions about a topic, inquiry-based learning experiences capitalize on students' curiosity and energize their learning. By doing this, students find information, organize it, and share it in a wide variety of forms, including writing, multimedia presentations, discussions, or websites (Moss,2005).

Cervetti, Barber, Dorph, & Pearson (2012) developed an inquiry-based, science-literacy integrated curriculum by considering Yore's (2004) idea of language as a ''critical communication and thinking tool'' that is ''integral to science'' (Yore, as cited in Cervetti at el. 2012). They demonstrated their curriculum model with a unit fourth grade on light, which

requires students to read, write, research and discuss in order to acquire knowledge about important science concepts and develop research and literacy skills needed to be effective in science. The unit includes a set of roles for texts, including guided interactions with nonfiction texts, that directly support student participation in inquiry and represent the ways in which scientists use texts in science activities. An integrated science unit engages students in reading texts, writing notes and reports, conducting first-hand investigations, and frequently discussing key concepts and processes necessary to acquire inquiry skills and knowledge about science concepts. The treatment intervention involved eight sessions and reading science books in each class with a framework that involved pre-, during- and post-reading activities. Prior to reading, students typically set goals for their research and were given selected techniques for understanding, such as prediction and description. Students read books with partners and then explored what they had learned from the text. The instructors utilized Pearson and Gallagher's (1983) gradual release of responsibility approach, which includes the steps of (1) directly explaining and modelling the strategy, (2) providing guided practice with the strategy in the context of reading, (3) providing opportunities for independent practice during reading over the course of the unit, and (4) regularly discussing the utility of the strategy and its application to other situations. Students read the books in pairs, then explored their learning from the text in a classroom and the effectiveness of the technique for understanding implemented before reading, which was to start by thinking about what they knew and what they wondered about light and then making predictions before they began reading. *Can You See in the Dark?* is a book that activates students' curiosity as to whether people need light to see. Next the students begin to conduct investigations with flashlights. They continue by reading *The Speed of Light,* in which the speed of light is compared with that of other objects to illustrate how fast light is. Finally,

students write information-supported summaries of what they know about light. This curriculum is based on the understanding that engaging students in reading, writing and discussing directly related to their own research supports not only their conceptual understandings but also their ability to communicate these understandings in conversation and writing, which are important dimensions of informational literacy (Cervetti, Barber, Dorph, & Pearson, 2012).

Similarly, Girod and Twyman (2009) developed and experimentally compared two innovative and high-quality curricula in two second-grade classes, “Seeds: An Experimental Science and Literacy Blended Unit” as the focal curriculum, and “GEMS, Great Math and Science Explorations: A Hands-on, Inquiry-based Curriculum” for comparison. In the Seeds unit, which was designed to promote science and literacy processes as complementary to each other, featured informational texts, reference materials, fictional materials, and biographical texts describing scientists' lives and activities as well as inquiry text modeling procedures. As the comparison program, GEMS had the same curricular emphasis as the Seeds unit but without literacy components. GEMS activities introduced essential principles and concepts by involving students in direct experience and experimentation as well as having them read four short informational texts. Reading in the Seeds classroom provided the students with the ideas of science and allowed them to interpret the text to be interpreted as opposed to assimilating information in the GEMS classroom. It was usual for the Seeds instructor to ask questions about the author's intended meanings. Writing, which was used in the Seeds unit to add interest to the science unit either technically or creatively, was not an integral part of the GEMS science unit. In comparison, students in the Seeds classroom experienced many different types of writing, each closely linked to the unit's content. As a result, the Seeds curriculum of experimental science and literacy had some advantages over the inquiry-oriented GEMS curriculum. Results showed that

students in the experimental group had a significantly higher understanding of the nature of science. The Seeds curriculum also promoted the students' abilities to read, write, and talk like a scientist (Girod & Twyman, 2009).

Reading and writing are ways in which scientists accomplish their tasks. Scientists make notes, records, charts, diagrams, sketches, schematics, etc. and compose definitions (Norris & Phillip, 2003). In science education, writing has two main academic purposes: the inculturation of learners into a particular discourse (genre perspective) and the personal involvement of learners (diversification perspective) (Yore, Hand, Goldman, Hildebrand, Osborne, Treagust & Wallace, 2004). Scientific language used in informational texts for young learners provide models of scientific writing. As the process of writing enables students to organize and respond to sources of knowledge and practice their skills as scientific investigators, writing is an effective way to integrate literacy into STEM instruction (Bates, 2016). Activities like learning logs, for example, can engage elementary students in using writing as a reflective task designed to facilitate information retrieval. Learning logs are simply notebooks in which students record information, which can include questions about content, reflections on what students have learned, webs, charts, or diagrams of processes or events. These informal writing activities can be used to allow students to write for meaningful purposes about content learning in any subject, be it art, music, mathematics, or science. Furthermore, they provide teachers with information about the degree of students' understanding of a particular concept (Moss, 2005).

Merritt and Shifflett (2012) demonstrated that reading nonfiction books can support students' understanding of complex science relationships as well as provide evidence of what they have learned. They incorporated nonfiction trade books as supplementary materials in teaching fourth grade students about the complex relationships among the sun, earth and moon.

The students were engaged in reading nonfiction books about the sun, earth and moon in language arts. Library books and trade books of different levels were provided for both reading aloud and independent reading. For example, while students were learning about the moon phases in their science class, they read the books about why and how the moon has different phases. First, they modeled the moon's movement, and then the teacher explained key vocabulary and asking guiding questions to support their learning. As the last step, students created writing and drawing artifacts to express their questions and the answers they got from reading (Merritt & Shifflett, 2012).

Dallacqua and Peralta (2019) utilized nonfiction comics as informational sources for fifth grade students, who worked in groups to make notes and analyze the comics as valid informational texts. In the last step of instruction, the students were assigned to create their own comic books. The students found that the graphic format made the nonfiction literature entertaining and compelling, as well as structurally organized and informative. Indeed, this lesson served as a learning opportunity for students to reconsider nonfiction literature. Creating their own visual and written texts allowed the students to regulate their own learning as well as appreciate how they consume and construct meaning.

Informational texts which include problem solving procedures are not only forms of academic writing but also examples of how to solve problems as part of the inquiry process that is at the heart of every discipline, whether it is mathematics, science, or social studies. Pickering (1995) coined the phrase "dance of agency" to refer to the combination of identity as agency, and knowledge. These three components are the ways a person uses identity as a creative thinker, agency as one having the ability to impact a situation, and knowledge of relevant content and how to use it. In other words, by investigating how real people use real knowledge to solve real

problems, the research literature shows how knowledge is created and contributes to disciplinary literacy (Boaler, 2002, 2003; Pickering, 1995 as cited in Zarnowski & Turkel, 2011). Zarnowski and Turkel (2011) examined the use of three nonfiction texts for young readers that also showed how real people use knowledge and reasoning to solve problems by asking questions, finding answers, and revising their thinking. The researchers used the following inquiry-related questions when reviewing selected nonfiction texts and to activate the students' inquiry skills were;

- Who is doing the investigation?
- What is the problem?
- What is the process of investigation?
- What are the results? Are they convincing? (p.31)

By concentrating on the questioning process, participants gained insight into how research actually happens (Zarnowski & Turkel, 2011).

The Comprehension Continuum developed by Stephina Harvey and Harvey Daniels (2015) has six levels including (1) Answers Literal Questions, (2) Retells, (3) Merges Thinking with Content, (4) Acquires Knowledge, and (5) Actively Uses Knowledge. According to Vick (2016), teachers often consider only the first two levels in teaching informational texts but should use reading strategies that maximize comprehension, such as reading an informational text with a purpose, marking up the text, responding to the information, creating concept maps, and comparing and contrasting concepts. Reading informational texts with an intent or problem in mind helps students concentrate on "big ideas" instead of fragments information. By "marking up" texts with their own comments and questions, students can focus on summarizing and

questioning rather than just highlighting words superficially and develop their own questions for inquiry. They can use the important content that they identified should to write their own summaries. Responding to the material in the text by writing / journaling can be very useful when integrating prior learning with new content, as students may use the process to deal with contradictions and misconceptions. Concept maps are powerful tools for understanding, and it is important for students to build their own. The teacher or textbook should not pressure them to use a particular format. It is necessary for students to convey either how information and ideas are related to each other or clarify how they interact when they are not connected. Students can use graphic interactive organizers such as Venn Diagrams to compare and contrast ideas from the text before explaining them in writing or verbally. With a Venn Diagram, for example, students can differentiate between their prior and new knowledge on a subject and show the area in which the two types of knowledge converge. These instructional strategies were proposed to help teachers engage students in reading informational texts with maximum comprehension (Vick, 2016).

Children can develop many literacy skills needed for survival in the 21st century through reading aloud and shared, guided, and independent reading experiences with knowledge texts, including their subject area textbooks (Moss, 2005). Barnes and Oliveria (2017) investigated the strategy of reading informational texts aloud to teach scientific metaphors to elementary students so they could begin to gain theoretical understanding of complex scientific processes and topics. Reading a scientific text requires special skills as students need to integrate many features to gain comprehension. Besides precise academic language, science texts usually convey information via variety of visual displays including infographics, images, tables, diagrams, and so on. Many of these displays feature scientific metaphors, by which something difficult to comprehend or

envision is compared to something familiar, such as “the earth is a ball”, a concept that incorporates symbols, metaphors, figurative language, and analogies. Whole-class reading aloud of science texts is a method by which teachers may support students’ interpretation of scientific metaphors and other content by pausing for questions and discussion. In this study, a first grade and a second-grade teachers chose their own environmental books, in which pictorial representations of animal extinctions enabled whole-class discussions, which both facilitated with read-aloud techniques. The results show that using read-aloud strategies to help students understand content and metaphors in scientific information texts can help teachers achieve curriculum objectives. The researchers also suggest that if the students are motivated to consider how to convey data and interpretations, they may be able to develop a critical scientific mindset, question what they observe, and seek understanding (Barnes & Oliveria, 2017).

The use of informational texts in the elementary grades can help students gain comprehension of material and construct knowledge across a wide range of subjects. For this purpose, using read-aloud methods with informational texts to convey complex information can help students understand, including those who struggle with comprehension. (Santoro, Baker, Fien, Smith, & Chard, 2016) discuss the case of Mr. Alexander, who prepares special education students for their general science class. Mr. Alexander purposely chooses many thematically linked information texts to be used in his small-scale read-aloud sessions in order to support students’ understanding of the sophisticated vocabulary and content in the science unit. He decides to read informational books aloud while giving students opportunities to ask and answer questions about the content. As an example, his first read-aloud book is about the general subject of insects. With this book, students can ask questions such as "What is an insect?" “What do insects eat?" and “Where do insects live?”. He also collects books on various insect types (e.g.

ladybugs, butterflies). Mr. Alexander plans to encourage students to ask questions while he is reading these books, such as “What do ladybugs look like?” “What do ladybugs eat?” and “What are ladybugs’ habitats?” Mr. Alexander prefers to read texts aloud to help students prepare for their general science class because he can provide breaks for discussion and vocabulary preparation, and his students can concentrate on language and interpretation without the extra effort of trying to read the text independently. Mr. Alexander also recognizes that by using reading aloud methods and oral language delivery, he can expose students to complex texts without the demands of high reading skills (Santoro at el., 2016).

Kuhn, Rausch, McCarty, Montgomery, & Rule (2017) compared the use of nonfiction and fiction texts to explore the explicit teaching of reading comprehension and vocabulary strategies in a first-grade and a second-grade class. The investigator used a repeated measures method in which the students in both classrooms switched between fiction and nonfiction texts every two weeks over an eight-week period, during which students were explicitly taught how to implement comprehension techniques such as determining importance, using a schema, and visualizing when engaging with the nonfiction or fiction genre. At the end of every two-week cycle, students’ vocabulary and use of comprehension techniques were measured. Teachers used mandatory district instructional resources and nonfiction books to teach vocabulary throughout every genre-specific unit. In each text, they targeted specific words and taught students how to use contextual clues to infer the meanings of these as well as other unknown or multiple meaning words. The findings of this research show that the use of nonfiction texts in primary grades can have a positive impact on students’ engagement in content learning and development of reading comprehension and building vocabulary skills (Kuhn at el., 2017).

Discussion

Overview

This review was undertaken to explore the use of informational texts in science teaching and to understand how researchers approach utilization of these texts in teaching science. The literature reviewed here indicates that teachers and researchers agree that integrated teaching of literacy and science lead to notable increases in students' comprehension and interest levels, specifically with the use of informational texts in elementary science classes. The combination of literacy and science helps students understand scientific concepts and improve their language skills (LaParo, Pianta & Hamre, 2008). Nonfiction trade books, nonfiction picture books, and other informational science-based texts familiarize students with scientific language and the inquiry methods modeled in these texts (Pappas & Varelas, 2009). Specifically, integration of reading informational texts and content learning can boost children's literacy development (Duke,2003) and their future success through grades (Moss, 2005), including their comprehension of science content (Norris & Philips,2003).

However, simply reading informational science texts may not be sufficient for children to build a solid understanding of key concepts in science. Stewart and Chesley (2014) state that teachers have a significant role in incorporating informational texts into science education. Without teachers' guidance, children are likely to have difficulty gaining a deep understanding of key concepts. Teachers' questions and teaching skills are crucial to children's conceptual learning in science. Teachers can integrate inquiry-based science instruction into informational texts by evaluating texts for selection, asking questions, exploring texts with their children (Mantzicopoulos & Patrick, 2011). To effectively integrate informational texts into science education, science teachers should develop lessons that begin with investigations, which with the teacher's guidance can generate questions to be pursued through the use of informational texts

(Vick, 2016). Incorporating informational texts into the 5E model provides opportunities for students to obtain, evaluate, and communicate information from sources as scientists (Royce, 2015). Nonfiction materials have advantages over fiction materials in teaching reading comprehension and vocabulary strategies. According to Kuhn at el. (2017) nonfiction books support children's vocabulary and reading comprehension more than fiction books. Similarly, Van den Broek (2010) found that informational texts design makes clear links between elements in the text and the reader's background knowledge, thus helping to increase understanding of scientific concepts and to correct misconceptions.

Science based informational texts are often good tools to provide scientific facts, concepts and clarifications. It is also seen that informational textbooks are related to real life and support inquiry-based learning science education. Fountass and Pinnell (2001) indicate that informational texts cover all research areas of interest to readers, including geology, sports, religion, space, technology, history, animals, and cooking. In addition, to this, reading and writing are strongly related to learning science and understanding the nature and structure of science (Norris & Phillips , 2003). Literacy approaches promote children's critical thinking and reasoning skills and allow them to develop a deeper understanding of scientific theories and the science around them (Liston & Hennessy, 2016). When students are engaged in reading expository texts such as nonfiction trade books, nonfiction picture books, narrative texts, informational texts, they benefit from exposure to scientific language and the methods of inquiry that are modeled in the books (Pappas & Varelas, 2009).

In some of the studies given above, it has been suggested that more effective use of informational textbooks can be used in science education. Scientists research the natural world by experiments and based on evidences and they need sources and texts to reasoning the

evidences. As National Research Council define scientific inquiry as the ways which scientists research the natural world and make explanation based on evidence from their study (NRC, 1996). From this point of view, science education should be based on inquiry based strategies and modal and informational texts should be accommodated in inquiry process. Santoro at el. (2016), Barnes and Oliveria (2017), Vick (2016) correlate instructional strategies with informational text use of teaching science. The results highlight instructional strategies with the use of informational text such as reading text with a purpose, marking up a text, responding to the information, concept maps, compare and contrast concepts (Vick,2016) and read-aloud (Barnes & Oliveria,2017; Santoro at el., 2016). These strategies help children with making connection between texts and their exist knowledge, thus children's learning of science concepts are increase. The 5E model (Engage, Explore, Explain, Elaborate, and Evaluate) is used to create lesson design with nonfiction books (Royce, 2015). This suggests that an active learning environment is important in order for students to receive maximum benefit from nonfiction books.

Future Research Implications

In general, all the studies examined and support the use and emphasize the importance of informational textbooks in science education. To be effective, informational text books should have features that provide information about science, facilitate understanding, and enrich students' knowledge of scientific language. To fulfill Common Core State Standards for science it is suggested that curriculum planners and teachers consult the opinions of scholars with expertise in classroom uses of informational texts and nonfiction books. It is further suggested that teacher educators and researchers in literacy and science education continue to monitor and evaluate the practices of educators and make recommendations for productive applications.

The literature review also shows that read-aloud strategies were used in most implementations that incorporated informational texts. Future studies could further facilitate development of different strategies. Also, the most studies in the reviewed literature were conducted in advanced elementary grades. Future research should focus on use of informational texts with younger students in early grades, including the extent to which the practice facilitates science and literacy learning and promotes their development in later grades. For instance, nonfiction picture books could be used to guide children in early grades to conduct experiments in science education.

Lastly, future research should investigate students' perceptions of the use of informational texts in teaching science, including what strategies they prefer most, what types of books they prefer read, what science subjects they have interests in, and similar questions. By understanding their students' thinking, teachers can adjust the learning environment and effectively choose informational texts. Additionally, future research could obtain the views of parents through interviews or surveys to determine the extent to which they provide informational texts and/or read them to their children in the home and to assess students' out-of-school literacy and science experiences.

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Curriculum Vitae

Esra Ibil

Education

M.S. Indiana University Bloomington, Bloomington, IN, January 2020. Elementary Education

I.E.P. Ohio University, Athens, OH, July 2016. Intensive English Program

I.E.P. Marmara University, Istanbul, TR, March 2016. Intensive English Program

B.A. Marmara University, Istanbul, TR, June 2013. Elementary Education

Experience

2014-2015 *Language Arts Teacher*: Teaching reading and writing to nondominant and marginalized group of students who are not enrolled in mainstream public schools, Uskudar Municipality Information Center for Children, Istanbul, TR.

2014-2015 *Art Teacher*: Teaching "Marbling Paper Art" to elementary education students, Uskudar Municipality Information Center for Children, Istanbul, TR